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Effect of Biodegraded (Fungal Strains) Sugar Mill Effluent on the Growth of *Phaseolus mungo* L.

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Microbial biodegradation have enabled detailed genomic, metagenomic, proteomic, bioinformatics and other high throughput analysis of environmentally relevant microorganisms providing unprecedented insights into key biodegradative pathways and the changing environmental condition. The present work has been carried for the biodegradation of sugar mill effluent with fungal strains. The Aspergillus niger treated effluent have the higher activity than the Penicillium notatum.The physico-chemical analysis of sugar mill effluent were observed that they contain higher amount of heavy metals, organic and inorganic chemicals. And also germination studies were conducted in biodegraded soil using black gram (Phaseolus mungo) under pot culture experiment and best germination, length of shoot, root and total leaf area were noticed in microbial treated than the effluent soil.

Key words: Effluent, Black gram, *Aspergillus niger,Penicillum notatum.*

Industrialization is the key to the economical development of the nation. During its production, industries generate useless byproducts and waste materials with the quality of parent chemicals (Verma and shukla,1969).Among the industries sugar mill play an major role in creating pollution of water bodies and soil because the effluent contain higher amount of organic and inorganic chemicals. They harmfully affect the soil properties when used for irrigation. The effluent irrigation mainly disturbs soil micro macro nutrients which are very much important for green revolution (senthilkumar *et al*., 2001).

Effluents discharged from sugar mill contains a number of chemical pollutants such as carbonate, bicarbonate, nitrite, phosphate, oil and grease in addition to total suspended solids, volatile solids and score of other toxicants. These pollutants could bring about changes in temperature,humidity,oxygen supply, pesticide stress etc amounting to a partial or complete alteration in the physical, chemical and physiological spheres of biota (Borale and patil, 2004).when the untreated effluent are discharged in to the environment, they disrupt the ecosystem (Manivasagam, 1997).

Microbial biodegradation has intensified in recent years as humanity strives to find sustainable ways to cleanup contaminated environments (Behera and Mishra, 1985).This study may open a venue for a possible mitigation of the effluent problem and also the biodegraded effluents are convertible into highly fertile manures for several crops and the biodegraded effluents

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tested with black gram (Phaseolus mungo) through germination study.\\

MATERIAL AND METHODS

Collection of sample

Sugar mill effluent samples were collected from the point of discharged stream of sugar mill situated in Tamil Nadu; India.The effluent was collected in plastic containers and stored in refrigerator. The effluent was analyzed for its various physico-chemical parameters as per the method of APHA, 1992.

Isolation and identification of fungal strains

From the sugar mill effluent, the fungal strains were isolated by serial dilution and examined by lacto phenol cotton blue technique (Machly, 1967). The fungal strains were identified according to their morphological characteristics.

Pot Culture experiment

The seeds of black gram (Phaseolus mungo) were procured from Department of Agricultural University, Coimbatore, India. The surface sterilized black gram seeds were equispacially arranged in earthern pots and various morphological parameters were analyzed.

Control – (sterile soil + seeds)

Effect of sugar mill effluent-(sterile soil – sugar mill effluent + seeds

Degradation ability of microbes-(sterile soil + effluent + microbes + seeds)

Morphological and Biometric Analysis

The number of seeds germinated in treated pot was counted after one week and germination percentage was calculated by using the formula.

$$\text{Germination percentage} = \frac{\text{No. seeds germinated}}{\text{Total no. of seeds sown}} \times 100$$

The leaf area was calculated by measuring the length and breadth of the leaf described by yosidha, 1972.

Leaf area (cm) = K × length × breadth

Where k = Kemp's constant

The length of the root and shoot was measured individually for plant and expressed in cm.

RESULTS AND DISCUSSION

The results of the physico-chemical analysis of sugar mill effluent are presented in (Table-1).The physico-chemical analysis of the sugar mill effluent was yellow in color with acidic in nature and decaying molasses odour.It contained higher amount of total dissolved solids (TDS), hardness,turbidity,biological oxygen

Table 1. Physico-chemical characteristics of treated and untreated sugar mill effluent

S. No	Characteristics	Initial(raw) effluent	After treatment	
			Penicillium notatum	*Aspergillus niger*
1	pH	5.8	6.8	7.1
2	Turbidity	0.25	0.15	0.18
3	Colour	Pale yellow	colourless	Colourless
4	Odour	Decaying molasses	odourless	odourless
5	Total Dissolved Solids(mg/L)	686	562	568
6	Chloride(mg/L)	23	4.2	5.2
7	Acidity(mg/L)	0.65	0.43	0.51
8	Calcium(mg/L)	83	72	76
9	Magnesium(mg/L)	286	106	110
10	Hardness(mg/L)	320	217	267
11	Dissolved oxygen(mg/L)	36	12	13
12	Chemical Oxygen demand(mg/L)	1086	795	816
13	Biological Oxygen Demand(mg/L)	993	836	872

Table 2. Effect of sugar mill effluent on growth of black gram (Phaseolus mungo)

Parameter	control	Effluent soil	Treatment	
			Effluent soil + Penicillium notatum	*Effluent soil* + Aspergillus niger
Germination ability (%)	100	80	100	100
Shoot length (cm)	6.6	6.2	7.0	7.4
Root length(cm)	5.7	5.0	4.7	6.1
Leaf length(cm)	4.1	4.1	4.1	4.8
Leaf breath(cm)	1.7	1.9	2.1	2.4

demand (BOD), chemical oxygen demand(COD).In addition there was a considerable amount of chloride,calcium and magnesium present in the effluent.The same constitution were also noted in sugar mill effluent by Baskaran et al., 2009.

The variation in physico-chemical properties of sugar mill effluent may be due to the raw materials and chemicals used in the processes involved in sugar production (Shivappa *et al*., 2007).

Sugar mill effluent sample was degraded by isolated two dominant fungal strains such as Aspergillus niger and Penicillium notatum.The degradation ability were analyzed based on the physico-chemical characteristics. The degraded sugar mill effluent sample also compared with raw sugar mill effluent sample (Table-1).The Aspergillus niger treated effluent have the higher ability than the Penicillium notatum.

In pot culture experiment, the germination percentage, shoot and root length were measured and presented in table-2.The higher growth of shoot and root lengths were recorded at treated soil than the untreated effluent soil.The increase in germination ability were observed in microbial treated soil than the effluent soil. Similar findings were also noted by Field et al .,1993.The increase in germination ability might be due to the reduction in level of toxic metabolites by biodegradation and microbial treatment in the effluent .In addition to that, the total leaf area also increased in treated than the untreated one.

Finally, the isolated Aspergillus niger had highest degradation ability of sugar mill effluent than Penicillium notatum which was recommended for the use of degrading the sugar mill effluent in industrial level.

CONCLUSION

It can be concluded that the sugar mill effluent is toxic to crop and it can be used for irrigation purpose after a proper treatment with appropriate dilution and biodegradation using fungal strains.

REFERENCES

1. APHA, AWWA and WPCF, Washington, D.C. 1992; 16th edition.
2. Baskaran, L., Chidambaram, AL.A. Sundaramoorthy, P., Unnikanan, P. Bioreclamation of sugar mill effluent polluted soil using earthworm and its responses on green gram (*Vigna radiata* L.). *J. of Phytology*, 2009; **1**: 7-12.
3. Behera, B.K., Mishra, B.N. The effect on sugar mill effluent on enzyme activities of rice seedlings. *Industrial Research*, 1985; **37**: 390-398.
4. Borale, D.D., Patil, P.R. Studies on physico-chemical parameters and concentration of heavy metals in sugar industry. *Poll. Res.*, 2004; **2**: 83-86.
5. Field, J.A., De-Jong, E., Feijoo- Costa, G., De-Bent, J.A. Screening for ligninolytic fungi applicable to the biodegradation of xenobiotics. *Trents Biotec*., 1993; **11**: 44-49.
6. Machly, A.C.B. Methods of Biochemical analysis. Inter. Sci. Publications, Inc.New York. 1967.
7. Manivasagam, N. In industrial effluents, origin, characteristics, effluent analysis and treatment. SakthiPublication,Coimbatore. 1997.
8. Senthilkumar, R.D., Narayanasamy, R.., Ramakrishnan, K.Pollution studies on sugar mill effluent, physico-chemical characteristics and toxic metals. *Poll.Res.* 2001; **20**: 93-97.

9. Shivappa, D., Duttaiah, E.T. Kiran, B.R. Physico-chemical characteristics of sugar mill effluents-current scenario in Bhadravathi Taluk, Karnataka, India. *J. Industrial Pollution control*, 2007; **2**: 217-221.
10. Verma, S.R. and Shukla, G.R. Pollution in pernial stream Khala' the sugar factory effluent near lakes. *Env. Health,* 1969; **11**: 145-163.
11. Yoshida, S.D., Fordo, J., Cock. Gomez, K. Laboratory manual for physiological studies of rice. 3rd edition. The Inter. Rice Resea. Institute. Phillipines. 1972.